Original Article

Impact of exercise intervention on anxiety levels and mood profile of Greek prison inmates

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ABSTRACT

Imprisonment is clearly associated with mental health problems among prisoners. Evidence across research literature shows that exercise in detention environments improves mental health. The purpose of the study was to examine the effect of an exercise program on mood profile and anxiety of inmates in Greek prisons. Sixty male inmates randomly assigned in two groups (control and experiment). Individuals of the exercise group received a 12 weeks training program at a frequency of three (3) training sessions each week of 60 minutes per session. Control group individuals did not participate in the exercise program. The Profile of Mood States (POMS) and The State-Trait Anxiety Inventory (STAI) were administered to both groups prior and after exercise intervention. The findings of this study support the beneficial effect of exercise on mood and anxiety of inmates in Greek prison settings. **Keywords:** Prison; Exercise; Mood; Anxiety.

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INTRODUCTION

Prisons exist to enforce societal rules, maintain the safety of the general population and provide punitive sentences to offenders (Ward, Longaker, Williams, Naylor, Rose, & Simpson, 2013). Unhealthy conditions that exist in prison environments, poor lifestyle choices such as smoking, drug use, less training opportunities and low levels of physical activity often adopted by inmates, are all factors resulting to higher rates of health related problems (Fazel & Baillargeon, 2011; Naidoo & Wills, 2010; Marshall, Simpson, Stevens, 2000).

Imprisonment is also clearly associated with mental health problems among prisoners (Nurse, Woodcock, & Ormsby, 2003). Depressing and dirty surroundings, poor nutrition, aggression of any kind such as physical, verbal, racial or sexual abuse, lack of purposeful activity, availability of illicit drugs and either enforced solitude or lack of privacy, are all factors frequently reported to affect mental health of inmates (WHO, 2013). As a result, inmates suffer from high rates of anxiety (Boothby & Clements, 2000), stress and depression (Plugge, Douglas, & Fitzpatrick, 2006) and low levels of self-esteem (Igomu & Mayange, 2013), within overcrowding prison populations that continue to rise worldwide (Koulouris & Aloskofis, 2013; Walmsley, 2016).

Evidence across research literature shows that exercise in detention environments improves mental health related factors such as self-esteem (Basaran, 2016; Verdot, Champely, Clement, & Massarelli, 2010) mood (Hilyer, Wilson, Dillon, Caro, Jenkins, Spencer, & Booker, 1982) and quality of life (Mannocci, Mipatrini, D' Egidio, Rizzo et al., 2017), while reduces aggression (Williams, Collingwood, Coles, & Schmeer, 2015), anxiety and depression (Ghanbarzadeh & Mohamadi, 2012; Buckaloo, Krug, & Nelson, 2009) stress (Bilderbeck, Farias, Brazil, Jakobowitz, & Wikholm, 2013; Harner, Hanlon, & Garfinkel, 2010) and sense of hopelessness (Cashin, Potter, & Butler, 2008) among prisoners.

Despite their prominence in correctional environments around the world, exercise and physical activity are understudied areas of prison life, especially in Greece. Researchers in Greek prison settings focused on health conditions (Athanasopoulou 2016), detention facilities (Geitona & Milioni, 2016), mental status (Dandoulaki, Kosteri, & Milaki, 2008) and self-reported quality of life (Milioni & Geitona, 2017). These researches represent an initial attempt to examine the role of Greek providing prisons not only as detention facilities but also as rehabilitation institutions comprehensive and effective services and interventions so as to promote promoting well-being, social inclusion and care for people with mental health problems in accordance with WHO guide to Health in Prisons and Trenčín statement (2008) on prisons and mental health.

Nevertheless, did not include exercise intervention in their research design without exercise interventions. Only recently, the study of Psychou, Kokaridas, Koulouris, Theodorakis and Krommidas (2019) has started to pay attention on the effect of exercise on improving quality of life, since Greek prison inmates do not always have access to the yard even for one hour a day despite legal provisions (Koulouris, & Aloskofis, 2013).

Physical activity also results in short-term psychological effects, associated with mood improvement in the everyday lives of inmates, suggesting that exercise interventions can increase feelings of vigour and self-esteem and reduce anxiety, fatigue and tension (Bataglia, Di Cagno, Fiorilli, Giombini et al., 2015; Nelson, Specian, Tracy, & DeMello, 2006; Basaran, 2016). Nevertheless, the systematic study of exercise interventions associated with mood improvement has only begun, especially in the case of inmates detained in Greek correctional settings where no other studies have been conducted so far.

The purpose of the study was to examine for the first time in Greece the effect of an exercise program on mood profile and anxiety of inmates in Greek prisons and to proceed to related assessment of exercise as a valuable tool for inmates to cope with stressful living conditions within prisons.

METHOD

This study and its randomized control trial protocol and procedures were reviewed and approved by the DPESS University of Thessaly Ethics Committee Board and the Ministry of Justice, Transparency & Human Rights of Greece.

Sample

The sample consisted of 80 male adults, 25 to 53 years of age. All participants were inmates in Correctional Institution of Grevena, Greece. Pre- intervention phase included a medical examination conducted from the prison's medical team for ninety (90) inmates with a previous prison time of at least 2 years and with no prior participation in exercise whatsoever. Inmates having any physical or mental disease that forbids exercise participation were excluded. Eighty (80) men met all the above-mentioned eligibility criteria. Furthermore, all participants were aware of the program training procedures and they agreed to sign the consent participation form and the completion of the POMS and STAI instruments prior and after exercise intervention.

The initial sample of 80 inmates was randomly assigned in two equal groups of 40 participants each one, selected randomly by drawing lots. Due to prison release or transport to another prison during the application of the exercise program 20 inmates did not complete the study. Thus, the concluding number of participants evaluated in post measures was reduced to 25 and 35 individuals for the control and experiment group correspondingly (N = 60; M_{age}: 40.68±8.15 years).

Procedure

Exercise group

Individuals of the exercise group received a 12 weeks training program at a frequency of three (3) training sessions each week of 60 minutes per session. The exercise protocol has been designed based on an incorporation of separate protocols commonly used (Acevedo-Pabón, Manrique-Abril, & Ospina-Díaz, 2015; Bataglia et al., 2015; Pérez-Moreno, Cámara-Sánchez, Tremblay, Riera-Rubio, Gil-Paisan, & Lucia, 2007).

The workout took place in all available indoor and outdoor facilities of Grevena Correctional Institution including a soccer field, an indoor gym and the prison yard. The materials used for the exercise included mats, free weights, resistance bands, medicine balls, swiss balls and ping pong tables.

Each session included a 10-minute warm-up period of walking, jogging and stretching exercises. The study followed as main part of each exercise session different activities each time to maintain interest and training effect and included: a) Circuit resistance training programs, b) Sport games participation, c) Musical games and Greek traditional dance activities. Finally, a cool down period of ten minutes including breathing and relaxation activities ended the program.

Control Group

Control group individuals carried on their daily prison activities, they did not participate in any exercise program and they just filled in all relative instruments used for the purpose of the study, prior and after intervention.

Instruments

The instruments used prior and after intervention, included the following:

The Profile of Mood States (POMS; McNair, Kerr, & Droppleman, 1971), administered to examine the effect of the exercise program on inmates' distinct mood states. The questionnaire consists of 72 mood-related adjectives that form the basis of 6 mood conditions, namely, tension-anxiety, anger-hostility, fatigue-inertia, depression - dejection, confusion and vigour. All inmates were instructed to rate these adjectives on a 5-point scale ranging from "*not at all*" (0) to "*extremely*" (4). Five mood states were scored negatively (that is high scores are associated with more negative feelings) whereas vigour provided a positive score (high scores correspond to high vitality). Sub-scores were connected together to form an overall mood profile of each individual, resulting from the addition of the five "*negative*" mood states (tension, depression, anger , fatigue and confusion) and the subtraction of the "*positive*" vigour score (McNair et al., 1971), plus adding a constant of 100 to avoid negative scoring.

The State-Trait Anxiety Inventory (STAI) is a commonly used psychological inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), applied to diagnose and distinguish anxiety from depressive syndromes. STAI consists of 40 questions on a 4-point Likert Scale ranging from *"almost never"* (0) to "*almost always"* (4) that measure two types of anxiety, that is, trait anxiety (20 items) as a personal characteristic and state anxiety (20 items) about an event. Higher scores correspond to higher levels of anxiety.

Both instruments have been used in previous researches evaluating interventions for improving prisoners' mental health (Gold, Assmus, Hjørnevik, Qvale et al., 2014; Wagner, McBride, & Crouse, 1999).

Statistical analysis

All statistical analyses were conducted using Statistical Package of Social Sciences (version 18.0). Kolmogorov-Smirnov (K-S) test was applied to evaluate t normality of sample distribution. Most of the examined variables followed normal distribution in both (pre & post) measurements except state anxiety. Thus, a two-way repeated measures ANOVA (2x2) was conducted to examine possible differences between pre and post measures in all but one examined variables. As regards to state anxiety, two non-parametric tests were conducted, that is, a Mann-Whitney test to locate possible differences between the two groups in pre and post measures and a Wilcoxon test to examine probable differences between pre and post measures within each group. Level of significance was set at $p < .05$.

RESULTS

Kolmogorov – Smirnov analysis showed normality of distribution since no significant results ($p > .05$) were noted for all variables, except state anxiety (Table 1).

Results from two way ANOVAs with repeated measures revealed significant interaction of factors (variables and groups) on tension (Wilks' $\lambda = .336$, $F_{1,58} = 114.690$, $p < .001$, $\eta_p^2 = .66$), depression (Wilks' $\lambda = .237$, $F_{1,58} = 186.316$, $p < .001$, $\eta_p^2 = .76$), vigour (Wilks' $\lambda = .308$, $F_{1,58} = 130.066$, $p < .001$, $\eta_p^2 = .69$), anger (Wilks' $\lambda = .204$, $F_{1,58} = 226.446$, $p < .001$, $\eta_p^2 = .80$), fatigue (Wilks' $\lambda = .290$, $F_{1,58} = 141.769$, $p < .001$, $\eta_p^2 = .71$), confusion (Wilks' $\lambda = .333$, $F_{1,58} = 116.228$, $p < .001$, $\eta_p^2 = .67$), total mood profile (Wilks' $\lambda = .108$, $F_{1,58} = 476.989$, $p < .001$, $\eta_p^2 = .89$) and trait anxiety (Wilks' $\lambda = .316$, $F_{1,58} = 125.741$, $p < .001$, $\eta_p^2 = .68$).

Additional analysis of these interactions revealed significant differences on tension ($F_{1,58} = 254.675$, $p < .001$, $\eta_p^2 = .82$), depression ($F_{1,58} = 377.133$, $p < .001$, $\eta_p^2 = .87$), vigour ($F_{1,58} = 283.887$, $p < .001$, $\eta_p^2 = .83$), anger

($F_{1,58}$ = 473.903, p < .001, η_p^2 = .89), fatigue ($F_{1,58}$ = 325.979, p < .001, η_p^2 = .85), confusion ($F_{1,58}$ = 236.737, p < .001, η_p^2 = .80), total mood profile ($F_{1,58}$ = 1023.901, p < .001, η_p^2 = .95) and trait anxiety ($F_{1,58}$ = 285.458, p < .001, η_p^2 = .83) between pre and post measures only for the participants of the experiment group following the exercise program, with significantly higher scores achieved in all dependent variables in post measurements. No significant differences were noted between pre and post measures of the control group (p > .05).

Table 1. Means, standard deviations and Kolmogorov-Smirnov (K-S) test of the examined variables in pre and post intervention measures (N=60).

	Pre			Post		
Variables	**M±SD**	**K-S**	***p***	**M±SD**	**K-S**	***p***
Tension	2.45±.81	.791	.559	1.88±.97	.679	.746
Depression	2.55±.77	.711	.693	1.93±.92	.809	.529
Vigour	1.53±.83	.889	.408	2.30±1.07	1.218	.103
Anger	1.93±.86	.813	.523	1.39±.90	.791	.559
Fatigue	2.23±.85	.619	.838	1.59±1.02	.620	.836
Confusion	1.97±.59	1.024	.245	1.56±.65	.769	.596
Total Mood Profile	109.60±3.76	.588	.880	106.05±4.79	.573	.897
State anxiety	2.83±.54	1.930	.001	2.21±.73	1.447	.030
Trait anxiety	2.61±.42	.722	.675	2.25±.48	1.027	.242

M = Mean; SD = Standard deviation, K-S = Kolmogorov-Smirnov test, p = Level of significance (p > .05).

Between groups, no significant differences were noted in pre-measures for all dependent variables (p > .05). On the other hand, post-results showed significant differences on tension ($F_{1,58}$ = 254.675, p < .001, η_p^2 = .82), depression ($F_{1,58}$ = 45.440, p < .001, η_p^2 = .44), vigour ($F_{1,58}$ = 87.154, p < .001, η_p^2 = .60), anger ($F_{1,58}$ = 17.900, p < .001, η_p^2 = .24), fatigue ($F_{1,58}$ = 24.937, p < .001, η_p^2 = .30), confusion ($F_{1,58}$ = 12.087, p < .001, η_p^2 = .17), total mood profile ($F_{1,58}$ = 50.066, p < .001, η_p^2 = .49) and trait anxiety ($F_{1,58}$ = 60.131, p < .001, η_p^2 = .51), with participants of the experiment group achieving higher scores in all dependent variables compared to control group participants.

As for state anxiety, results of Mann Whitney non-parametric test showed no statistically significant difference (Z = -1.300, p = .193) on pre- scores between the experiment (mean rank = 28.03) and control group (mean rank = 33.96). In contrast, post-test results of Mann Whitney analysis revealed a statistically significant difference (Z = -5.897; p < .001) on state anxiety between the two groups with participants in the experimental group exhibiting lower levels of state anxiety (mean rank = 19.27) following the implementation of the exercise program compared to control group participants (mean rank = 46.22).

Furthermore, Wilcoxon non-parametric test results of state anxiety revealed significant differences between pre and post measures for the participants of the experiment group (Z = -5.161, p < .001) demonstrating lower scores of state anxiety following the implementation of the exercise program as compared to pre-intervention results (Table 2).

Table 2. Overall parametric and non- parametric results of the examined variables in pre and post intervention measures between and within groups.

	Pre		Post	
Variables	**Experimental** (M±SD)	**Control** (M±SD)	**Experimental** (M±SD)	**Control** (M±SD)
Tension	2.34±.76[a]	2.61±.87	1.33±.67[a b]	2.65±.79[b]
Depression	2.54±.69[a]	2.55±.87	1.42±.63[a b]	2.65±.78[b]
Vigour	1.62±.82[a]	1.40±.83	2.99±.67[a b]	1.33±.69[b]
Anger	1.99±.83[a]	1.83±.91	1.02±.73[a b]	1.90±.88[b]
Fatigue	2.23±.83[a]	2.22±.88	1.12±.82[a b]	2.25±.91[b]
Confusion	2.09±.59[a]	1.82±.56	1.34±.63[a b]	1.88±.54[b]
Total Mood Profile	109.57±3.57[a]	109.63±4.09	103.24±3.23[a b]	109.99±3.73[b]
State anxiety	2.77±.53[c]	2.92±.55	1.70±.31[c d]	2.92±.53[c d]
Trait anxiety	2.60±.42[a]	2.63±.43	1.96±.26[a b]	2.65±.42[b]

M = Mean; SD = Standard deviation; a Significant differences between pre and post measures for the experiment group (p < .05) based on 2x2 repeated measures ANOVA; b Significant differences between experimental and control group in post measures (p < .05) based on 2x2 repeated measures ANOVA; c Significant differences between pre and post measures for the experiment group (p < .05) based on Wilcoxon test; d Significant differences between experimental and control group in post measures (p < .05) based on Mann-Whitney test.

DISCUSSION AND CONCLUSIONS

This study examined the benefits of an exercise program on mood profile and anxiety levels of Greek prison inmates. Based on findings, two main conclusions were drawn. First, mood profile of experiment group participants improved following the twelve-week exercise program. Second, participants of the experiment group exhibited lower levels of anxiety following the implementation of the exercise program.

Comparisons with previous intervention studies show that exercise is associated with reduction in anxiety and stress levels. Bilderbeck et al. (2013) reported a positive effect of inmates in British prisons following a 10 weeks yoga intervention program, leading to a decrease of perceived stress and psychological distress of the participants. Mood however, was not evaluated using a specific instrument; rather, Bilderbeck et al. (2013) implied an indirect improvement of mood features due to perceived stress reduction. Harner et al. (2010) mentioned similar results concerning a decrease in anxiety levels of imprisoned women participating in a 12-week yoga intervention program.

Bataglia et al. (2015) also highlighted that high intensity exercise leads to lower levels of anxiety for inmates participating in a nine-month cardio and circuit resistance supervised training. Martin et al. (2013) evaluated stress levels after a six-week pilot nutrition and fitness training in a women's prison, with energy, sleep, and stress levels improved by the end of intervention for the incarcerated women completing the exercise program. Furthermore, Nelson et al. (2006) noted a positive effect of a more than six months regular moderate physical activity intervention on the stress levels of offenders with substance abuse and behavioural disorders enrolled in the program. Qualitative studies also reported similar improvement on stress and anxiety profile of inmates participating either in soccer, softball and Australian football (Gallant, Sherry, & Nicholson, 2015) or fitness coaching programs (Amtmann & Kukay, 2016), with both researches documenting mental health and well-being improvements following application of relative programs.

The use of physical activity programs in prisons as a developmental tool to promote well – being for inmate populations is widely recognized (Nichols, 2010), with three studies approaching psychological well-being as

a multi-dimensional construct using multiple measures (Bilderbeck et al., 2013; Harner et al., 2010; Hilyer et al., 1982). The study of Hilyer et al. (1982) used similarly the STAI and POMS instruments, revealing lower levels of anxiety following intervention along with a significant decrease in 4 out of 6 POMS affective mood states, that is, depression, fatigue, confusion and anger, although no significant changes were noticed in tension and vigour as in our case. Nevertheless, future researches when measuring well-being should note that the heterogeneity of interventions along with the methodological weaknesses, prevent any firm conclusions. Quite clearly, a wide range of strong measures with pre-post designs and follow-ups together with implementation of behaviour change theories within interventions are still needed (Woods et al., 2017).

Overall, along with the findings of our study it seems that physical activity programs produce similar positive results on reducing anxiety levels of inmates no matter the duration or the intensity of exercise interventions, although no clear answer is yet provided regarding the ability of one intervention design producing the greater impact (Woods, Breslin, & Hassan, 2017). Heterogeneity of relative interventions and results do not allow solid conclusions; however, a positive contribution is obviously noted in our study and others concerning the plain impact of exercise on reducing anxiety and improving mood states of inmates, leading to an improved psychological wellbeing of such populations.

Since this study is the first to examine anxiety and mood profile of Greek prison inmates, its findings could only be compared to relative researches conducted elsewhere. A systematic documentation of physical activity interventions in Greek detention facilities of different security levels still remains a distant future purpose, with larger samples of both male and female inmates needed to portray an overall picture of the effect of exercise interventions on improving prisoners' psychological health and coping with prison conditions. Nevertheless, the findings of this study are considered positive and encouraging.

AUTHOR CONTRIBUTIONS

D.P. conceived of the presented idea, designed and performed experiments, developed the theory and co – wrote the paper. D.K. encouraged D.P. to investigate, supervised the findings of this work and co- wrote the paper. N.K. encouraged D.P. to investigate and supervised the research. Y.T. supervised the project. C.K. analysed the data. C.P. contributed to sample preparation and helped D.P to carry out the experiment. All authors provided critical feedback and helped shape the research, analysis and manuscript.

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DISCLOSURE STATEMENT

The authors state that there are no conflicts of interest.

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